Channel 37, some observations and guesses

See also
https://agenda.linearcollider.org/event/6557/session/0/contribution/164

R. Cornat

Channel 37 is often found « noisy »

- …and then masked prior taking data.

- Not systematically in all chips
- Often in chips 0, 4, 8, 12
- Closest neighbors also flagged as noisy

Something specific to some chips ?

Something linked to the PCB layout ?

- In general, pedestal and rms are typical (chip alone test board, front-end boards).

- SearchNoisy algorithm only looks at ‘hit’ bit
  - Check if something wrong with ‘hit’ bit with channel 37

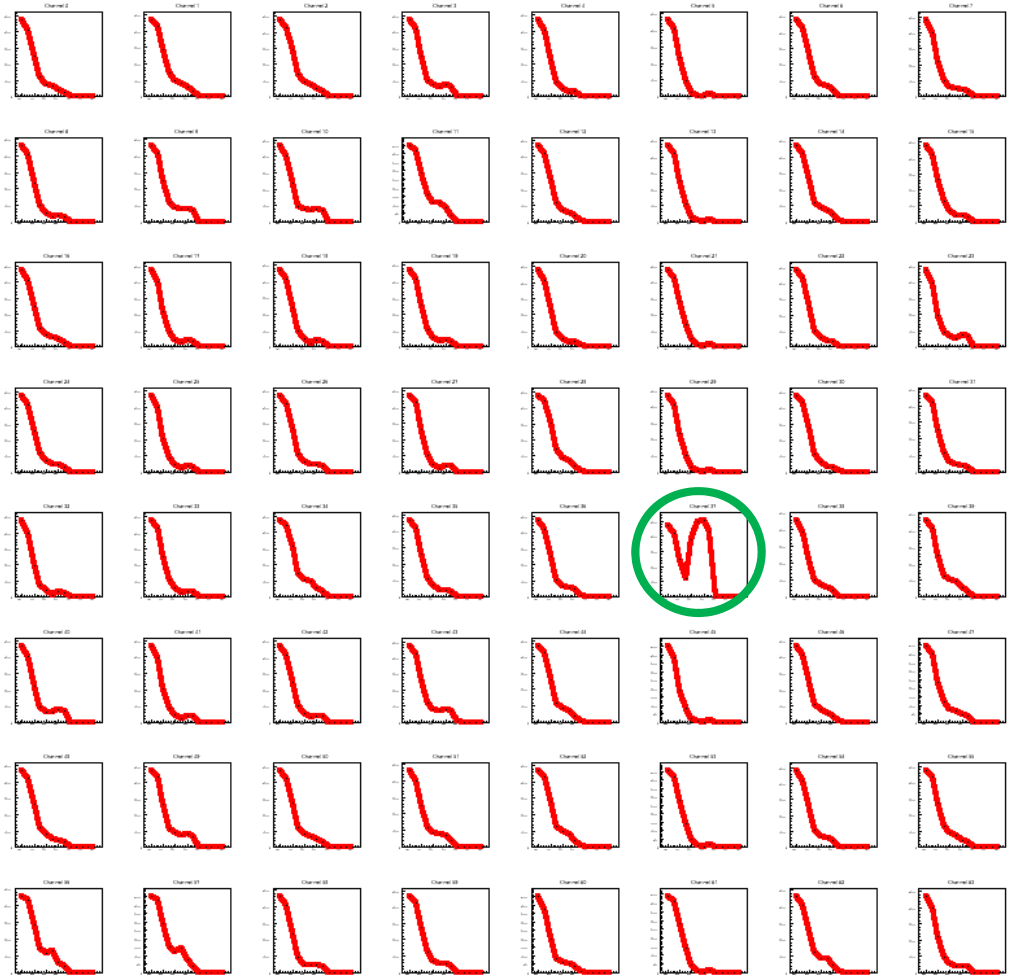
Scurves gives the number of ‘hits’ wrt. Global trigger level

Indeed, channel 37 has something wrong

Not for all chips

Similar but smaller « bumps » in other channels

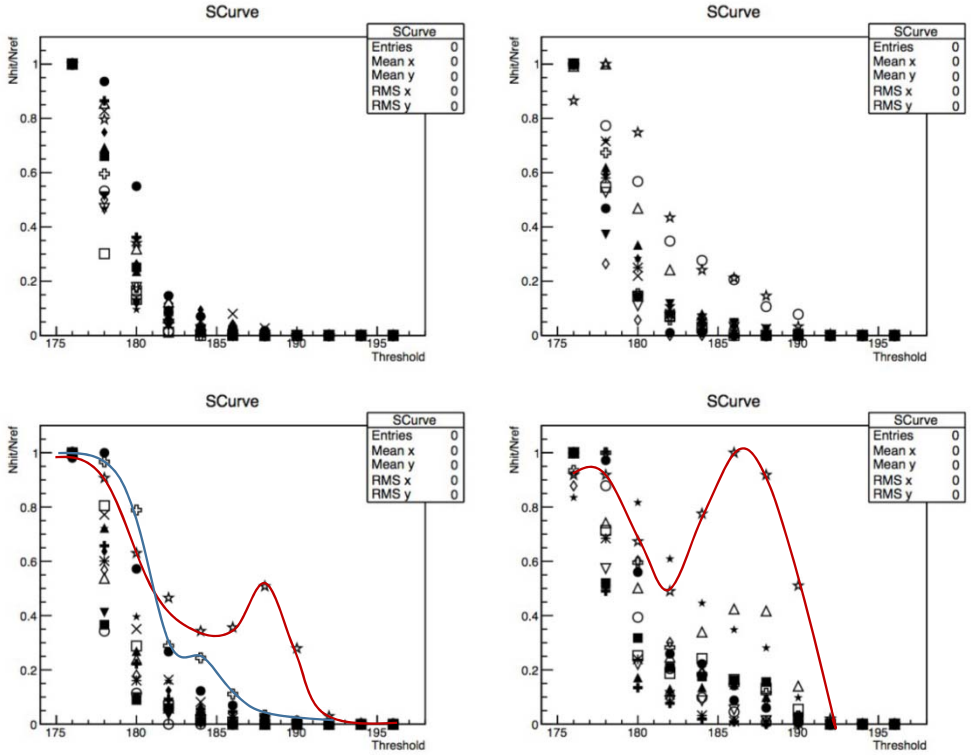
Chips 0, 4, 8, 12 : expected S curve but never reach 0 for high trigger thresholds



All the following is with power pulsing, all preamps powered

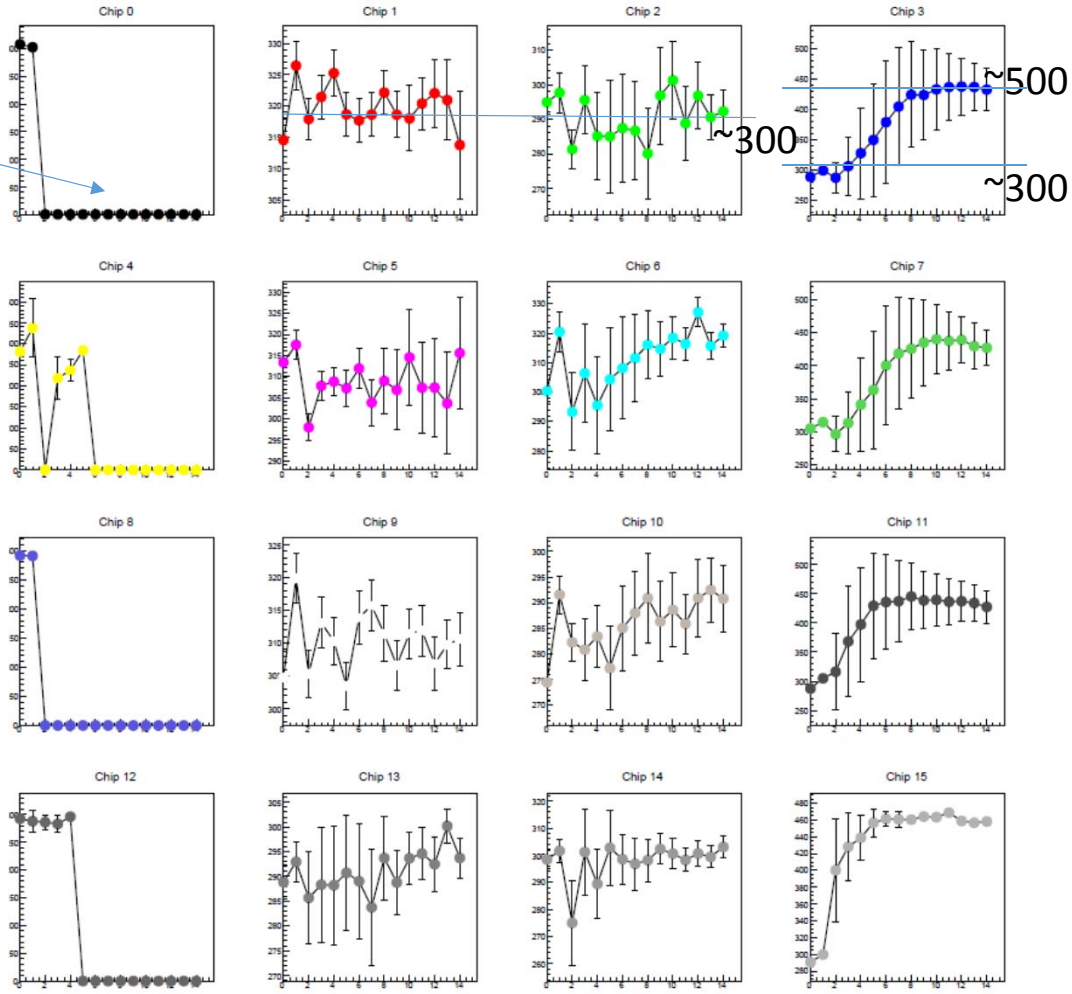
Bump also seen on COB version (no package, different PCB)

- R. Poeschl https://agenda.linearcollider.org/event/6892/session/6/contribution/4



Pedestal wrt. SCA in 16 chips @fixed Trig. Thres.

‘0’ means no data or out-of-range



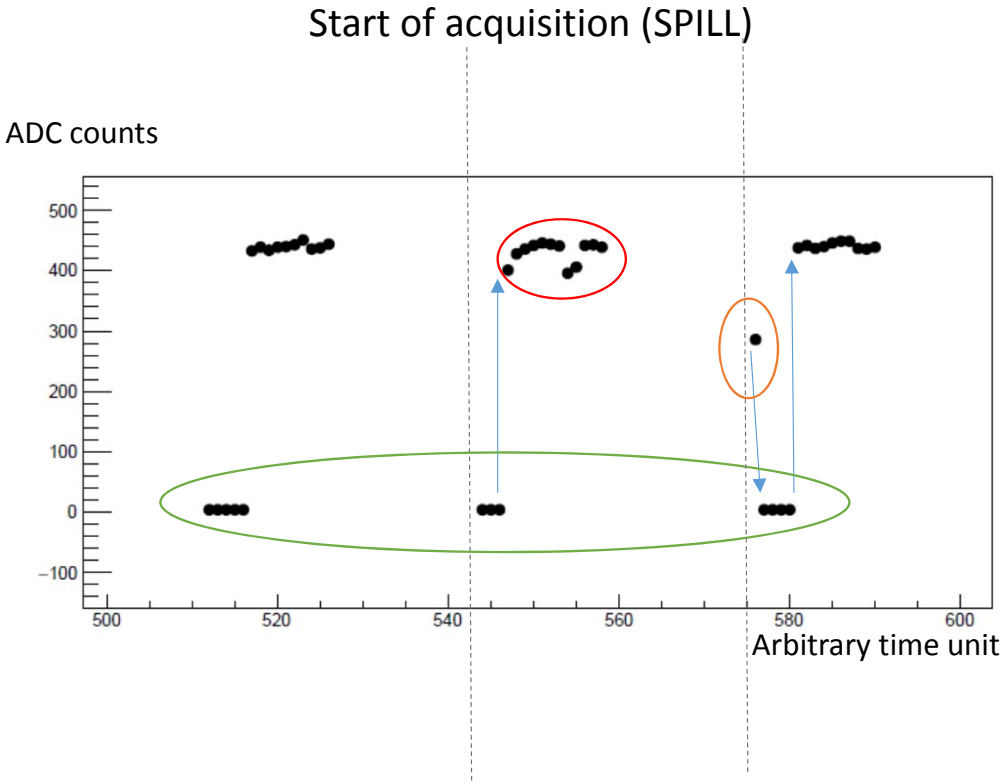
Data from Scurves

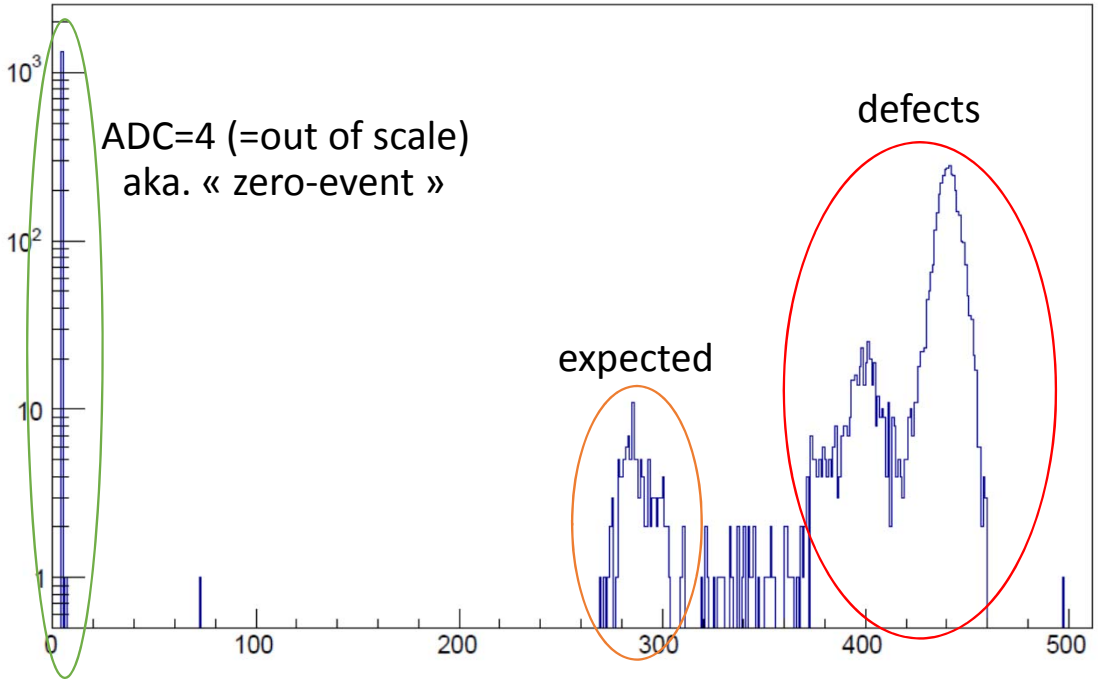
Depends on TT (here 205)

Chips 0, 4, 8, 12 : large deviation of pedestal from the baseline wrt. Time.

! Scales are not uniform

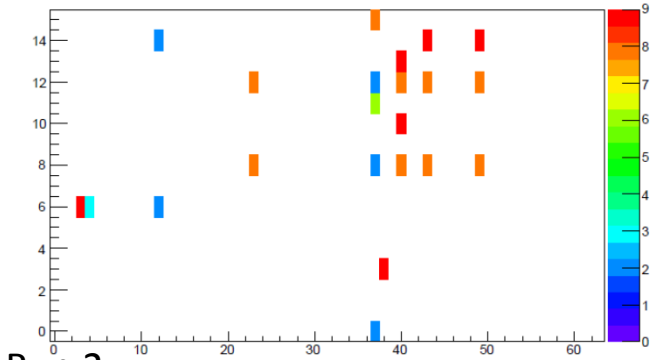
Time view of channel 37 spectrum



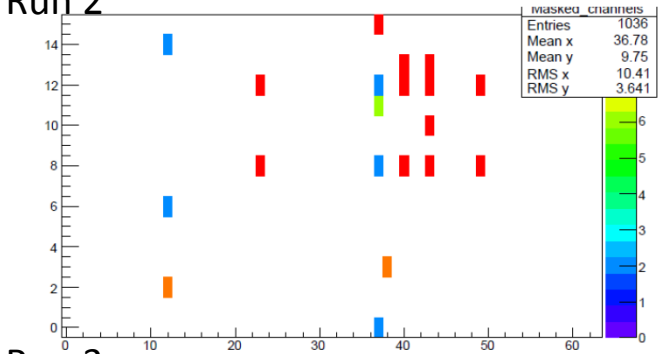


Masked channels (runs in same conditions)

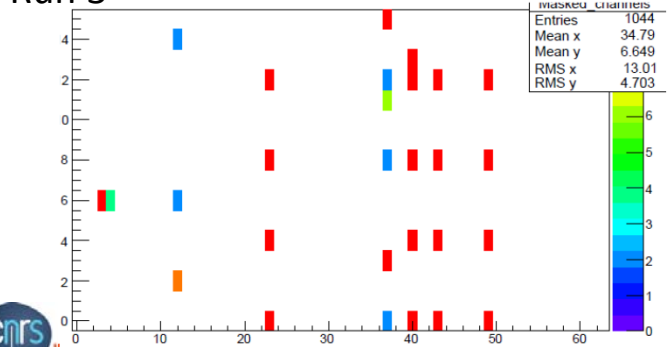
Run 1



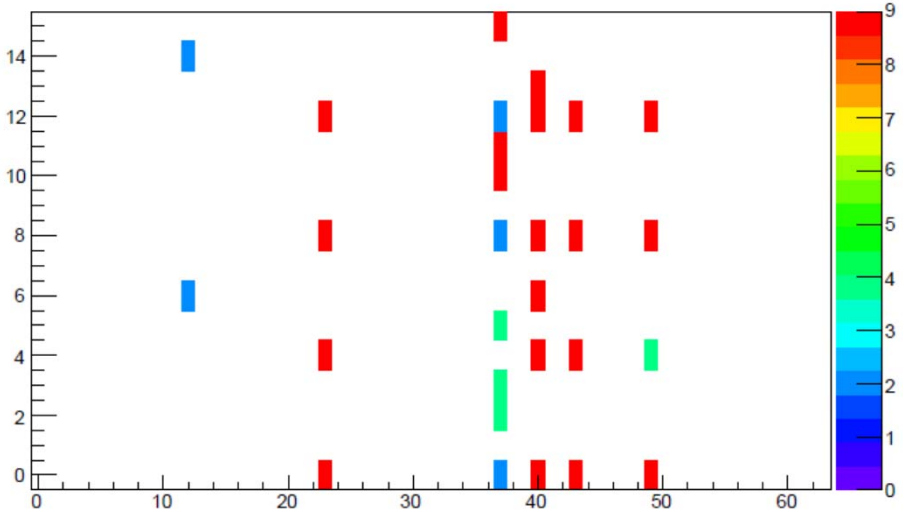
Run 2



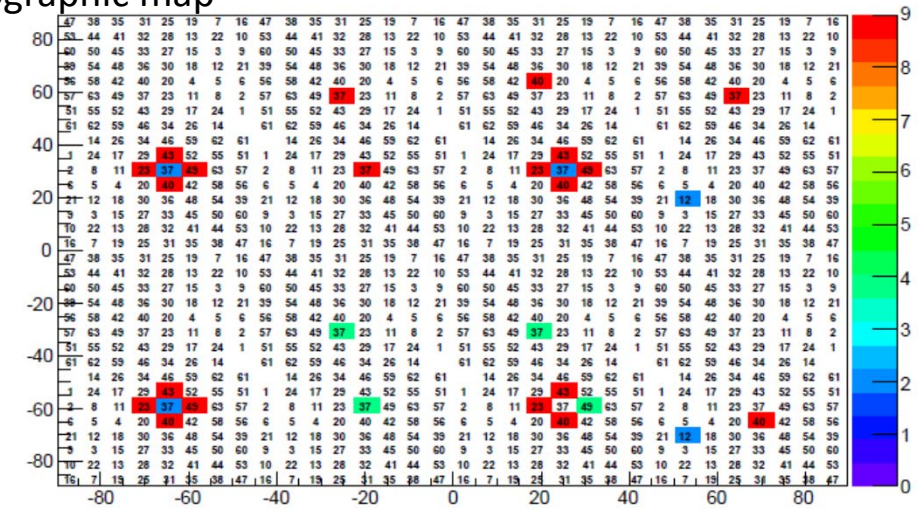
Run 3



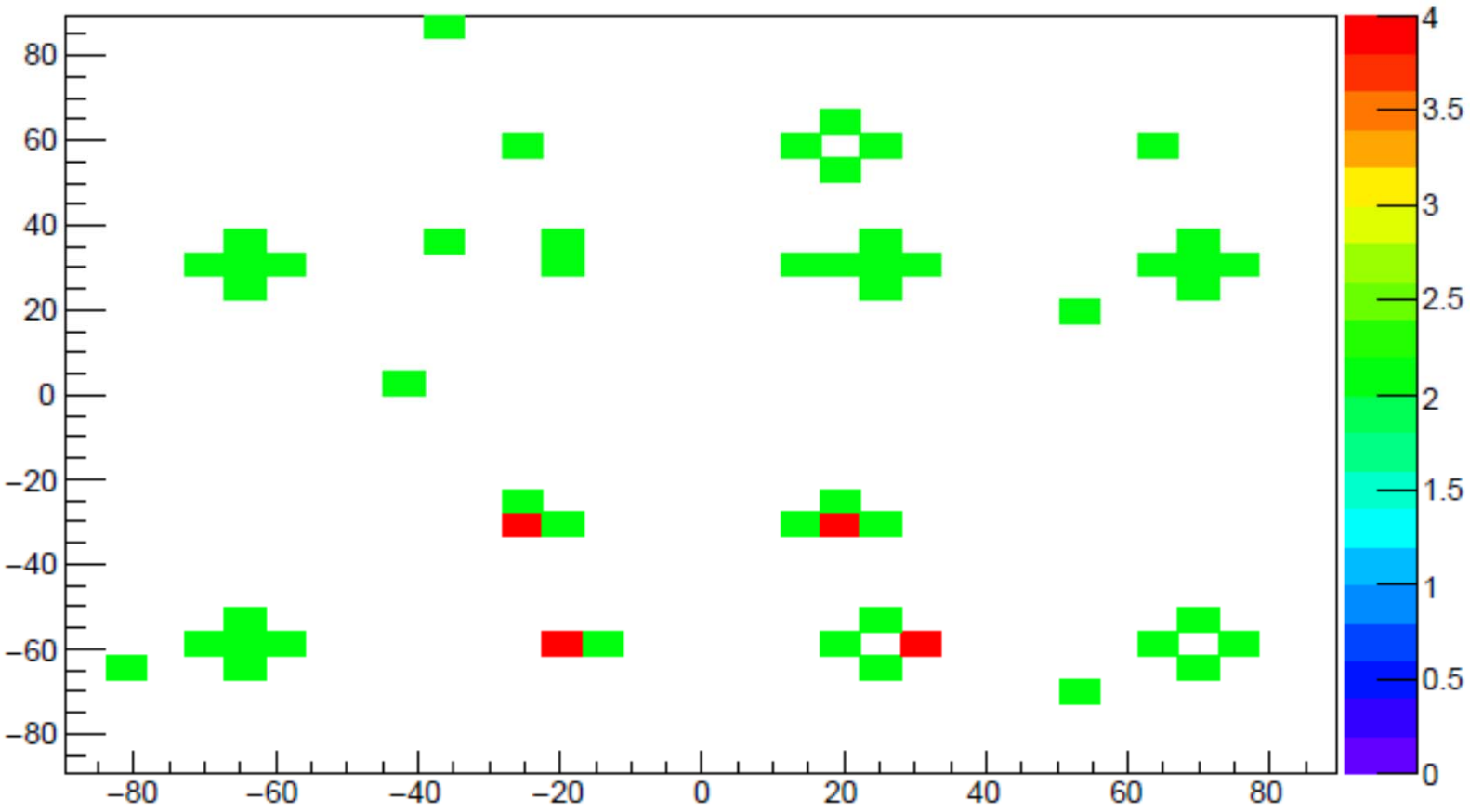
Run 4



Geographic map

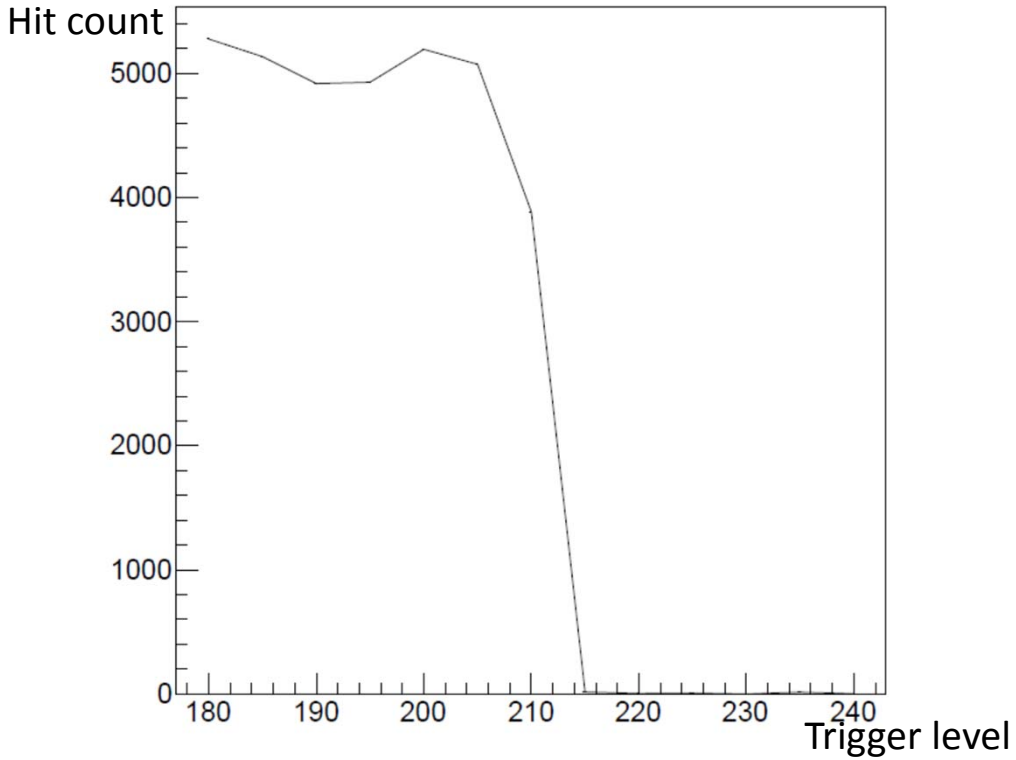


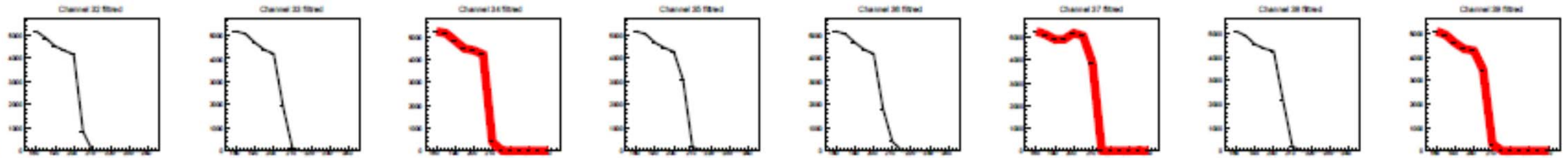
With noiseLevel=1E-3 (previous was 5E-3)



Scurve of channel 37 alone (all others masked)

BUT:

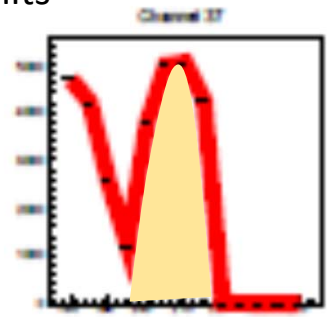




Same for channels 32 to 39

Partial conclusion

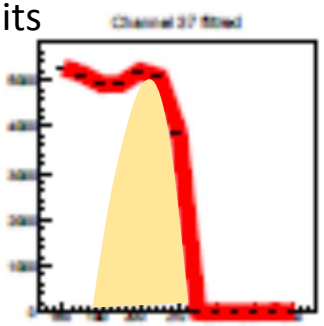
hits



Trig. Thres.

All channels « on » in PP
With 8 other channels not masked

hits



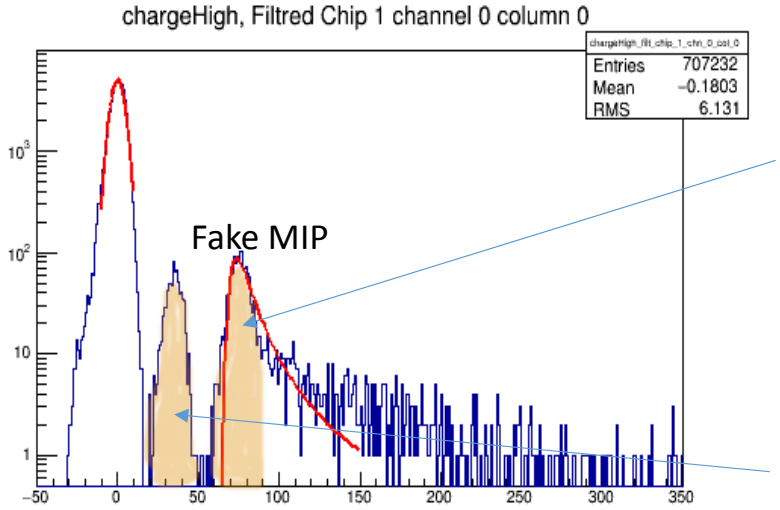
Trig. Thres.

All channels « on » in PP
With no other channels triggering

The « Bump » is probably still there in any cases
and for all the channels

It is probably <u>not</u> a noise, depends (mostly) on configuration of « trigger enable » bits,
can depends on external conditions

Annoter observation (may'15) : unexpected peaks



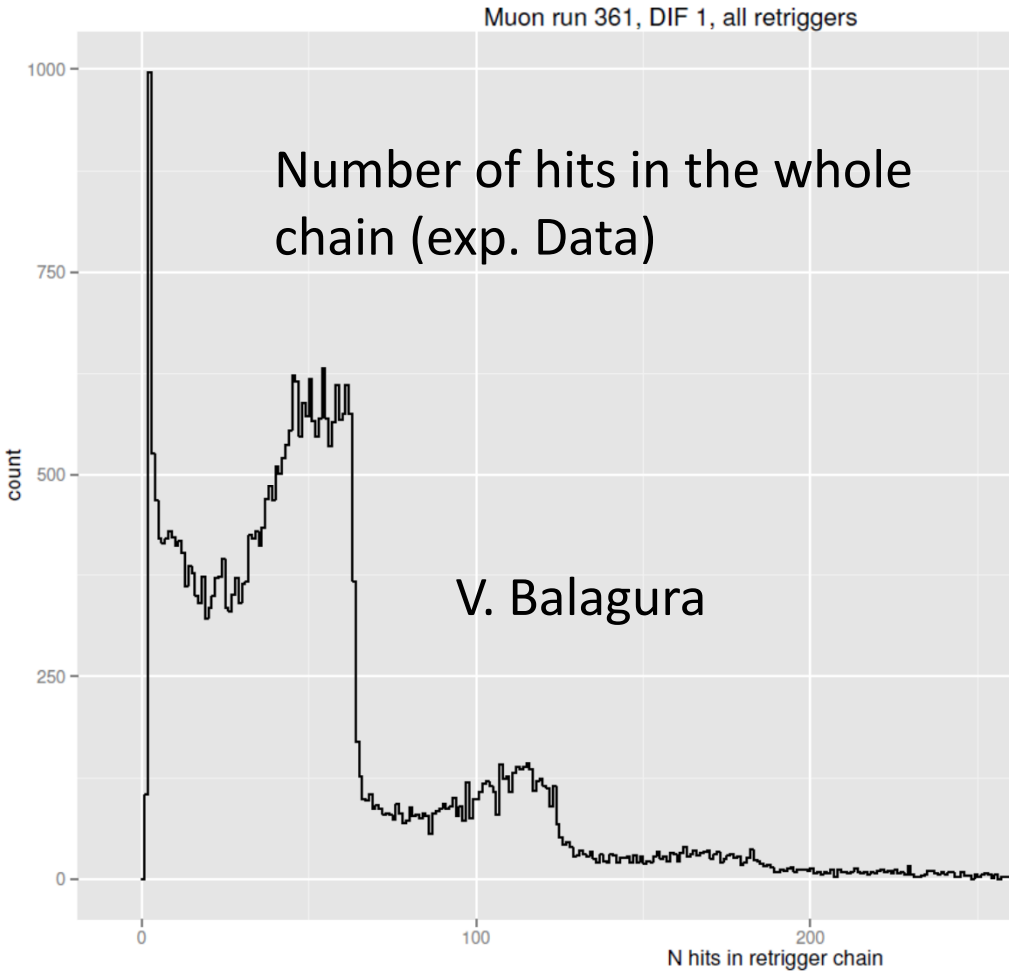
Correlated with data=4 (out-of-range) in channel **37** in several chips + chn 41-47 chip0.

Correlated with data= 4 in some other channels + number of hits > 10.

"zero-event" corrected in SK2a ?

Retriggers (aka. Successive BX)

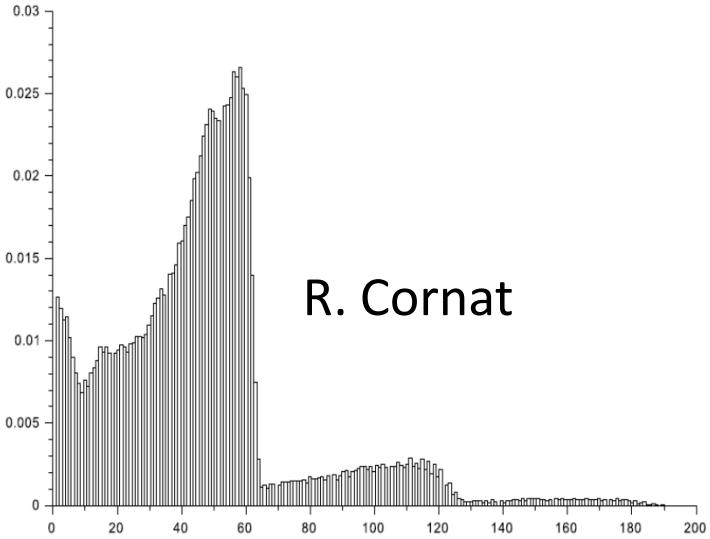
BX, BX+1…BX+N acquired in a burst



Number of hits in the whole chain (exp. Data)

V. Balagura

MC sim.



R. Cornat

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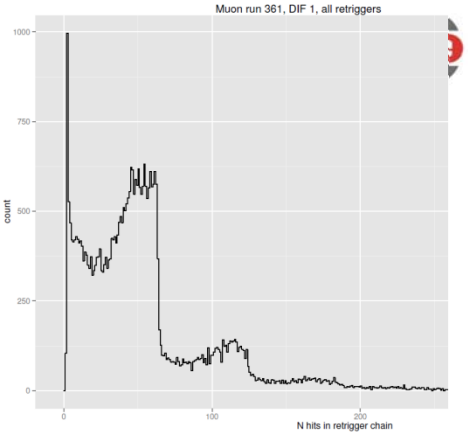
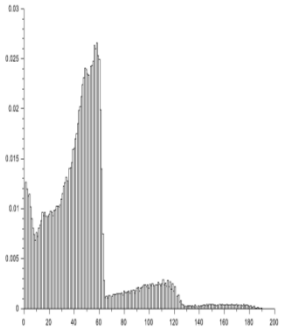
Retriggers (aka. Successive BX)





MC sim. assumptions :

- normal distribution of initial number of hits
  - all channels independent (independent random trials)
  - (constant) high probability to trig if not triggered previously
  - (constant) low probability to trig if already triggered
  - stops when close to a max. of already triggered
- **Nothing from chip's internal functioning (no SCA, …)**

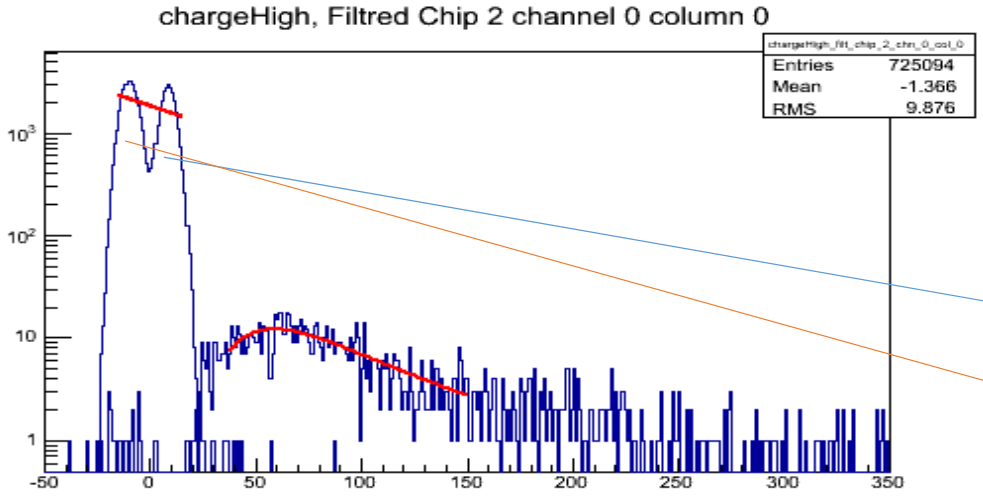
=> Memory effect (state variable)

=> sum(hits)>64 explained assuming that a full chain of successive BX is in fact a concatenation of several independent sub-chains with a probability that the next sub-chain restart immediately after the previous one.

Guesses (1)

⇒ Almost internal phenomenon
⇒ Self-sustained up to a certain point
⇒ Not really correlated to SCAs and internal timings/clocks

⇒ “Memory” effect can be explained as a charge accumulation injected from digital parts through substrate (change in offsets, bad bias of transistors etc.)



Indeed a correlation with double pedestal exists (detailed study by V. Balagura)

“NOT already triggered“ state

“HAS triggered” state

Guesses (2)

Assuming that channel 37 has nothing particular except being more sensitive to charge injection

⇒ Preamp can be badly biased then noisy (see the “time view”),

⇒ Or even (become) “blocked” : current from the diode could flow into closest neighbor pixels generating more noise (one can see that neighbor pixel or masked at the end of the FindNoisy algorithm)

This could explain the swiss cross pattern

⇒ Indeed, nothing clear seen in PCB layout or package layout concerning channel 37

⇒ Would be interesting to test on COB board